

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

a die having formed therein a semiconductor switching device and a schottky device,

5 said semiconductor switching device including a plurality of
trenches each including a pair of opposing sidewalls and a bottom wall and
each extending from a top surface of said die to a drift region in the body of
said die, channel regions of a first conductivity type formed in said die and
disposed adjacent the sidewalls of said trenches, a gate insulation layer
disposed on each sidewall of a trench adjacent a respective channel region,
10 conductive gate material contained within said trenches and insulated from
said channel regions by said gate insulation layers, and regions of a second
conductivity type opposite to the conductivity type of said channel region
each disposed at a sidewall of a respective trench and each extending from the
top surface of said die to a respective channel region;

15 said schottky device including a schottky barrier disposed over and
in schottky contact with a portion of the top surface of said die; and

a first contact in contact with said schottky barrier and said regions
of said second conductivity type.

2. A semiconductor device according to claim 1, further comprising
a second contact in contact with a major surface of said die opposite said first
contact.

3. A semiconductor device according to claim 1, wherein said semiconductor switching device is a MOSFET.

4. A semiconductor device according to claim 1, wherein said schottky barrier comprises TiSi_2 .

5. A semiconductor device according to claim 1, wherein said schottky barrier is disposed over a major surface of a mesa formed in said die.

6. A semiconductor device according to claim 1, wherein said schottky device further comprises a mesa having a trench formed on either side thereof, each trench having an insulation layer formed on its side walls and bottom and containing a conductive material.

7. A semiconductor device according to claim 6, wherein said schottky barrier extends over said sidewalls of said trenches.

8. A semiconductor device according to claim 1, further comprising a high conductivity region of the same conductivity as said channel region disposed between each pair of said regions of said second conductivity type and in contact with said first contact.

9. A semiconductor device according to claim 8, wherein said high conductivity region is located at the bottom of a recess in said die.

10. A semiconductor device according to claim 1, wherein each of said trenches includes a thick oxide layer at the bottom thereof.

11. A semiconductor device according to claim 1, further including a termination structure, said termination structure being comprised of a depression formed in said die to a depth below that of said channel region, a first insulation layer formed over major surfaces of said depression, a
5 conductive layer formed over said insulation layer, a second insulation layer formed over said conductive layer, and a termination contact formed over said second insulation layer, wherein said termination contact is in electrical contact with said conductive layer through said second insulation layer.

12. A method for manufacturing a semiconductor device, comprising:
providing a semiconductor die;
forming a schottky device in said die;
5 forming a trench type semiconductor switching device in said die
said semiconductor switching device including at least one power node; and
forming a common first contact in contact with schottky device and said at least one power node.

13. A method according to claim 12, wherein said trench type semiconductor switching device is a trench MOSFET.

14. A method according to claim 12, wherein said schottky device includes a schottky barrier comprised of TiSi_2 .

15. A method according to claim 14, wherein said schottky barrier is disposed over and in schottky contact with a portion of the top surface of said die.

16. A method according to claim 15, wherein said schottky barrier is disposed over and in schottky contact with a portion of a mesa formed in said die.

17. A method according to claim 16, further comprising a trench on each side of said mesa, each trench having an oxide formed on its sidewalls and containing a conductive material, wherein said schottky barrier is in schottky contact with said conductive material.

18. A semiconductor device comprising:

a die having formed therein a schottky device and a MOS-gated switching device, said schottky device including a plurality of schottky regions formed on a surface of said die, and said MOS-gated switching device including a plurality of gate structures, each structure including a trench having an insulation layer formed on its sidewalls and containing a conductive electrode;

wherein said gate structures are formed in groups and spaced from one another by a schottky region.

19. A semiconductor device according to claim 18, wherein said MOS-gated switching device is a MOSFET.

20. A semiconductor device according to claim 18, wherein each schottky region includes a schottky barrier comprising TiSi_2 .

21. A semiconductor device according to claim 20, wherein each schottky barrier is disposed over a major surface of a mesa formed in said die.

22. A semiconductor device according to claim 18, wherein each schottky region further comprises a mesa having a trench formed on either side thereof, each trench having an insulation layer formed on its side walls and bottom and containing a conductive material.